Beamline Quirks and "Gotchas"

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This is a partial list of quirks, oddities, and those little things you have to know about the beamline which would otherwise result in puzzling and frustrating failures. What I have in mind is the sort of thing where someone tells you "Oh, I forgot to mention – you have to flip the red switch three times before turning the stage on". This list is organized roughly by subsystem, so you can find relevant material when there's a problem.

1. Stage

   If the stage doesn't run, check the circuit breaker on the Aerotech controller on the right side of the electronics rack, under the notation "BR1032-06".
   On startup, any program using the stage will send it to its limits in all four cardinal directions. Make sure there's nothing in the way. This now means that there can't be a sample holder present because the bottom edge of the holder will bump into the I0-monitor holder.

2. Counters

   If the NI scalers don't count, make sure the output from Channel 0 is connected to the gate inputs of the other counters. This is done on the breakout box, which is a black box with a blue panel and lots of BNC's and wire terminals. It's an NI Model BNC-2121. Similarly, check to make sure this gate signal is connected to the XIA DXP's gate input. The XIA is the CAMAC module connected to the hutch.

   Counters 2 and 4 don't work, for reasons unknown. Use 1,3,5.

   The cables from the ion chambers to the Keithley amplifiers pick up a lot of 60Hz noise. Thus, if counting them with the NI scalers, use an oscilloscope to make sure the zero offset is enough to keep the amplifier outputs from crossing zero. There are low-noise cables which are a little thinner than 'normal' ones, have silver-plated connectors on the ends, and are labeled "Keithley".

   The counters and the detector are controlled by gate pulses which come from two different sources – the stage in XY mapping mode, and the NI6602 counter in EXAFS mode. There is a small box attached to the rack just upstream of the roll

slits which lets you select which signal is being used to control the detector acquisition. If you're doing fluorescence mapping and the switch is in the EXAFS position, you won't get any counts. The other possible error, having the switch in STAGE position while doing EXAFS causes a much more subtle problem. The stage gate is high when the stage isn't moving, so the detector will be gated on continuously, while the NI6602 scaler will be gated correctly. Thus, the counting of fluorescence photons won't be properly synced to that of I0, for instance. This will cause increased noise for no obvious reason.
There is an LED on the gate selector box which is on when the gate is on. In XY mode, this will be on continuously as the 'off' intervals are too short to see. In EXAFS mode, this will blink on during counts and off at all other times, such as monochromator moves. Look for this blinking to make sure you have it right.

3. Ge detector and LN2 system

If the LN2 storage dewar is empty or its valve is closed, and the LN2 fill system 'wants' to fill the detector, then it will open its valve and keep it open until the detector gets filled. If this doesn't happen for a long time, then the valve can overheat and get stuck in the open position. The fix for this is to close the valve manually using the switch on the LN2 fill controller (outside the hutch) and leave it closed for a while until the valve cools off. It will then work correctly. If any of this happens, the LN2 alarm will be screaming. To silence it, push the white button on the LN2 monitor in the NIM bin inside the hutch.

If the spectra from the detector are strange, the HV might be off, perhaps due to the LN2 having run dry. Clear any error condition and push the black reset button on the HV supply.

The single-element 'Iglet' detector doesn't have its HV auto-shutdown engaged yet. Be **very** careful to keep it full. Fill it Monday, Wednesday and Friday to be safe.

If you use the amplifier in the NIM bin to do analog counting, e.g. for navigation, be warned that it loads down the preamp, thus shifting all the peaks down. This means that you need to disconnect that cable before doing EXAFS. The cable is labeled 'Amp'.

The gate input to the XIA is used in two somewhat contradictory ways, depending on whether you're doing XY mapping or EXAFS. Thus, there is a switch box next to the plexi roll-slit enclosure which lets you choose where the gate comes from. Put the switch in Stage mode for XY scanning and EXAFS for MCA or EXAFS work. The red LED will indicate when the gate is on, hence the XIA counting enabled. This should blink rapidly when the measurement panel is open in the EXAFS program.

The XIA counters have a habit of 'freezing', especially at high count rates. The symptom is that the apparent count rate will stick at a constant value, regardless of what the beam is actually doing. The only way to un-wedge the detector is to re-initialize it from the config file. In the MCA program, hit the Set button to re-initialize. In the EXAFS program, there's a button for this purpose. During EXAFS scanning, the program will automatically re-initialize if it finds identical counts in any channel on two successive points. Thus, you lose only one point at a time. It also re-initializes at an interval that you can set.

4. Software

The jog buttons in the KnifeEdgeScan routine are a little flaky. They will sometimes do multiple steps on one press. Watch the light or the numbers. Also, the fit routine sometimes fails on the step or the derivative plot.

If you use any other program to move the mono while EXAFS is running, it will get confused and think the mono hasn't arrived. Fix this by pushing the 'Mono really got there!' button.

EXAFS doesn't save the offsets (dark counts) when LabVIEW exits. Be sure to redo them before taking data.

If you load the knife-edge program and then try to load the EXAFS program, it will bomb with a mysterious error. Load EXAFS first, then other programs.

5. Optics

The beam from the ring moves a little. If the incident intensity is low or noisy, try retuning the M1 tilt and roll. Don't touch the bend. To do this, make sure the slit centers are set at 14.125 (H) and 11.780 (V), using the BL 10.3.2 Main VI, then use the Single Motor Monitor VI to make the slits narrow (say, 100x25um). Insert the incident-beam monitor into the beam (this is the vertical vacuum motion feedthrough just before the hutch). There is a mark showing where it goes. Measure the current on this PIN diode and maximize it using the M1 tilt and roll. The jog sizes should be 0.002 (tilt) and 0.02 (roll). Tilt does horizontal, and roll vertical. Note: If in any sort of special mode, such as 2-bunch, the beam won't be in the same position as it normally is. If the beam is off a lot, you need to establish a new M1 tilt and bend and a new slit position. This should only happen after significant alterations to the ring. In that case, use the procedure on P. 142 of the logbook. The current amp for that PIN diode will sometimes read no signal or a very small signal when there should be a large signal. Fix this by power-cycling the current amp.

6. Mechanics

The roll slits have lots of backlash. The Single Motor Monitor tries to do the right thing about that by going to very negative values when you decrease the slit size. Therefore, you will see the beam blink out before it comes back. There's still some mechanical irreproducibility after all that, so don't take the read values of slit size too literally, especially at small size.

The Huber slits also have so much backlash that the calibration of the slit opening is almost useless. You can get a rough idea by seeing how much of the beam the slits block.

The Huber slits also have no encoders. Therefore, if they jam or the cable is unplugged, they lose calibration. To recalibrate, start by unplugging the cable from the slits. Use a dentist's mirror to see the mechanical indicators on the Huber block itself. Manually move the slit jaws so that they're fully closed and centered. Fire up the Huber program and work its controls so that the program thinks the jaws are closed and centered (both centers and openings = 0). Now reconnect the cable and open the jaws.

There are drifts of the optics as a function of temperature. Keep the hutch door closed as much as possible to keep the temperature constant. If the door is closed, the temperature seems to remain at 79-80^{o}F.